Yucca Mountain Program Update:
"Today's Solution to Nuclear Waste"

Presented to:
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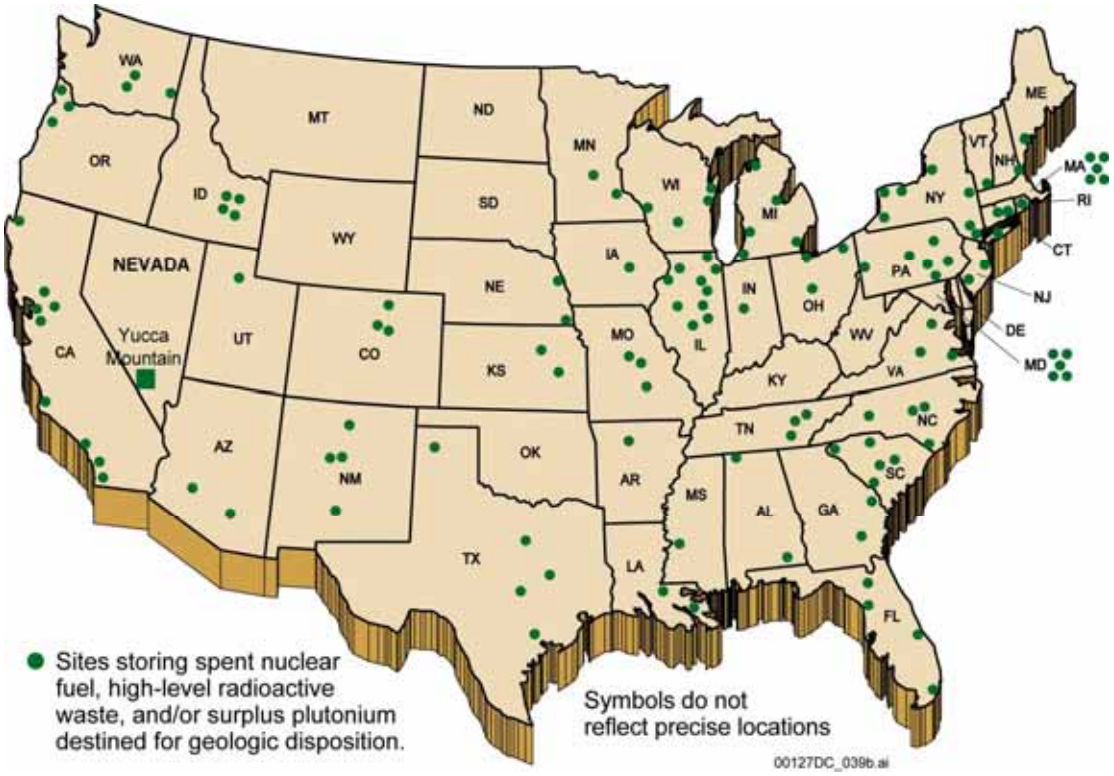
Program Mission

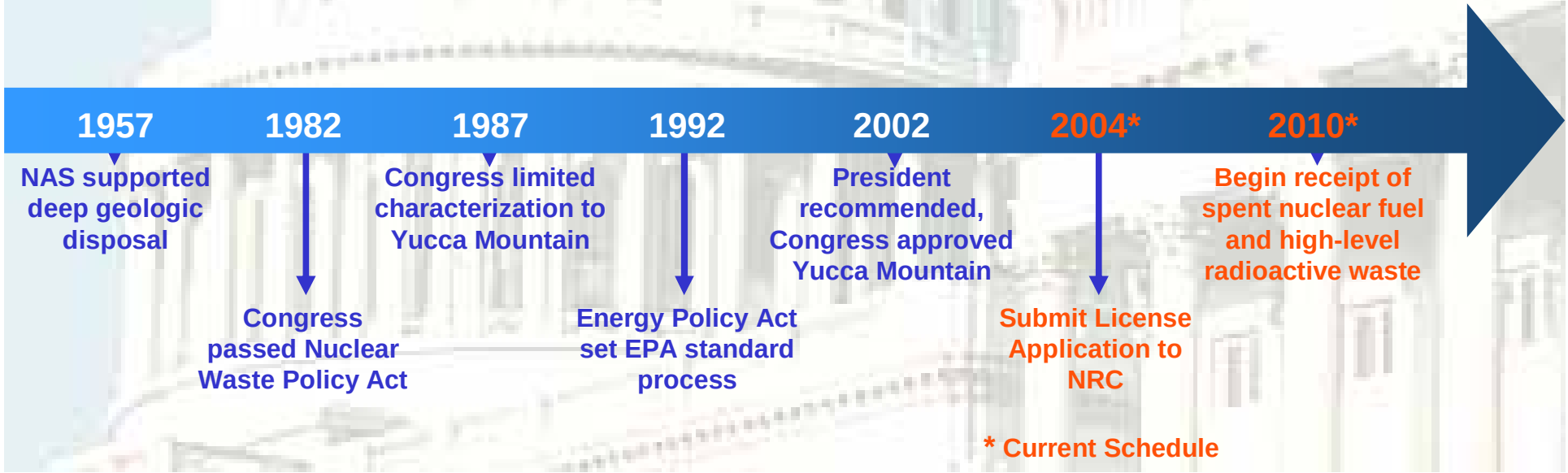
Our Mission is to manage and dispose of high-level radioactive waste and spent nuclear fuel in a manner that protects health, safety, and the environment; enhances national and energy security; and merits public confidence.



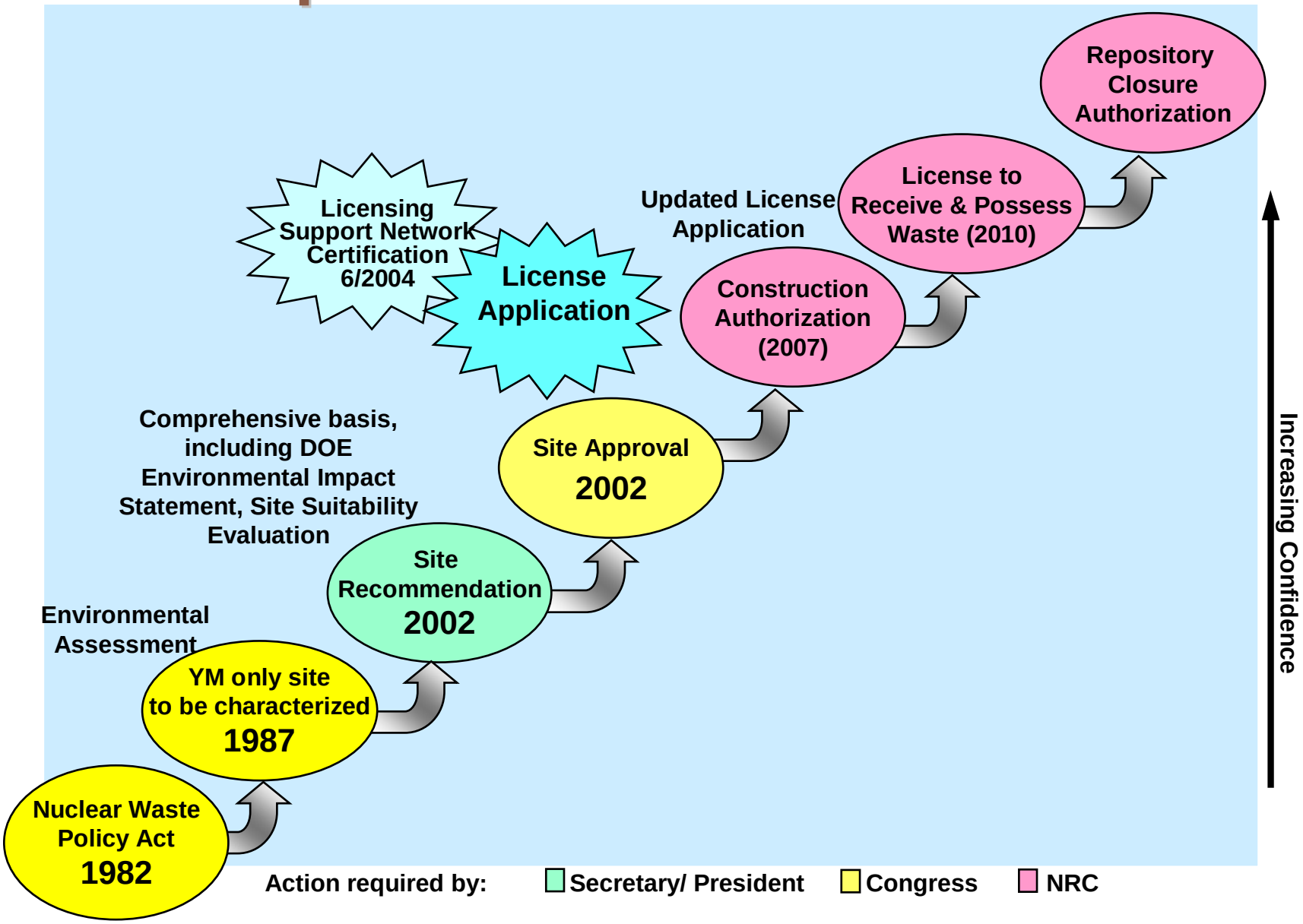
Current locations of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) destined for geologic disposal: 125 sites in 39 states

Congress Created a Legal Obligation to Dispose of Nuclear Waste

- **1982 - Nuclear Waste Policy Act (NWPA) established national policy for the disposition of high-level radioactive waste and commercial spent nuclear fuel**
- **1987 - Congress directed DOE to characterize only the Yucca Mountain site**
- **2002 - Congress passed a joint resolution approving the Yucca Mountain site for development as a repository**



Step-Wise Decision Process



Geologic Disposal Addresses Multiple Missions

Support Nuclear Navy Mission

Advance Nonproliferation Goals

- **Dispose of commercial spent nuclear fuel to ensure that nuclear power remains an important part of domestic energy production**
- **Consolidate nuclear wastes at one underground location to enhance protection against terrorist attacks**
- **Ensure effective operations of nuclear Navy by providing a secure place to dispose of its spent nuclear fuel**
- **Protect the environment by cleaning up defense waste sites permanently**
- **Advance nonproliferation goals by providing secure disposal of U.S.-origin foreign research reactor spent fuel**

Support Commercial Nuclear Energy Option

Support Defense Complex Clean-Up

Waste for Yucca Mountain

Commercial Spent Nuclear Fuel:
63,000 MTHM

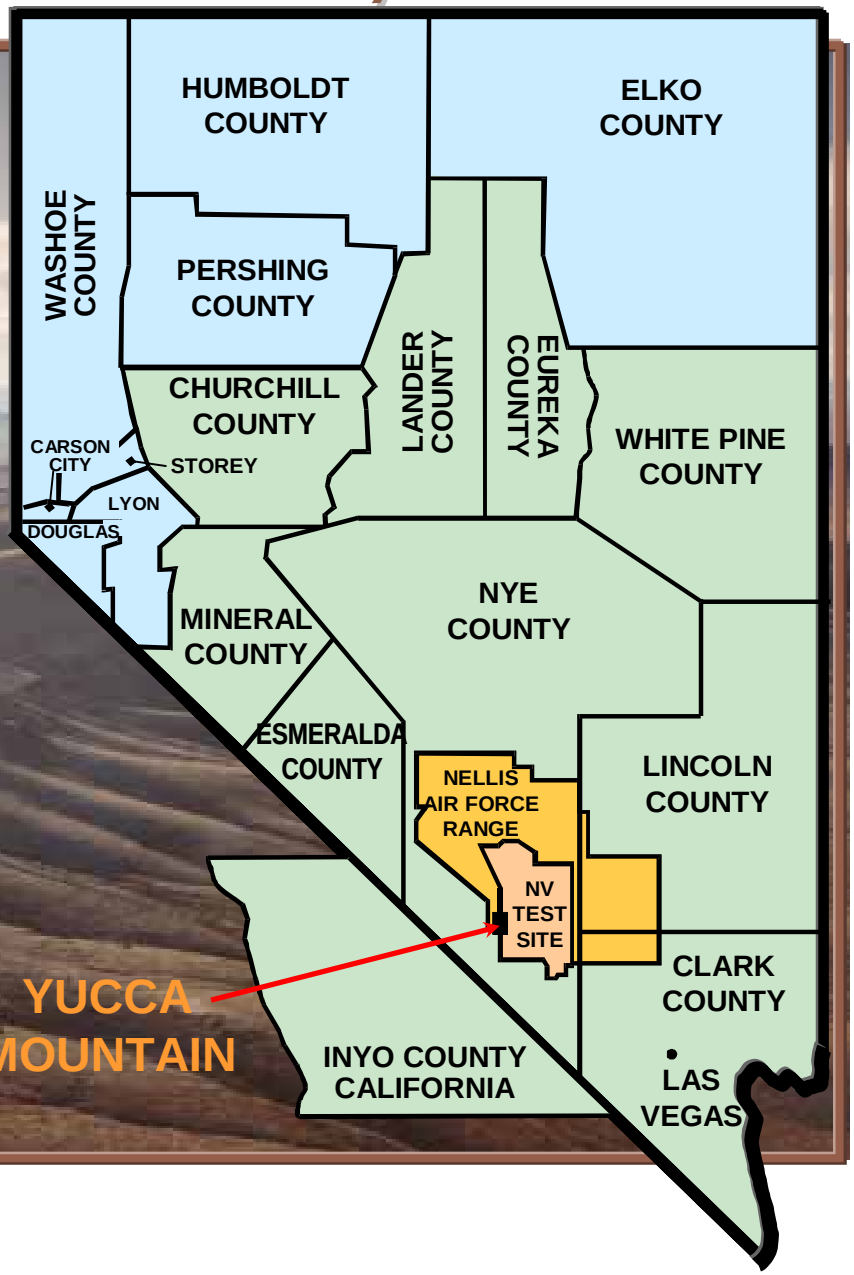
DOE & Naval Spent Nuclear Fuel:
2,333 MTHM

DOE & Commercial High-Level Waste:
4,667 MTHM

Location of Yucca Mountain, Nevada

Counties designated as Affected Units of Local Government

- 100 miles northwest of Las Vegas in Nye County
- Located on western boundary of the Nevada Test Site, a DOE facility

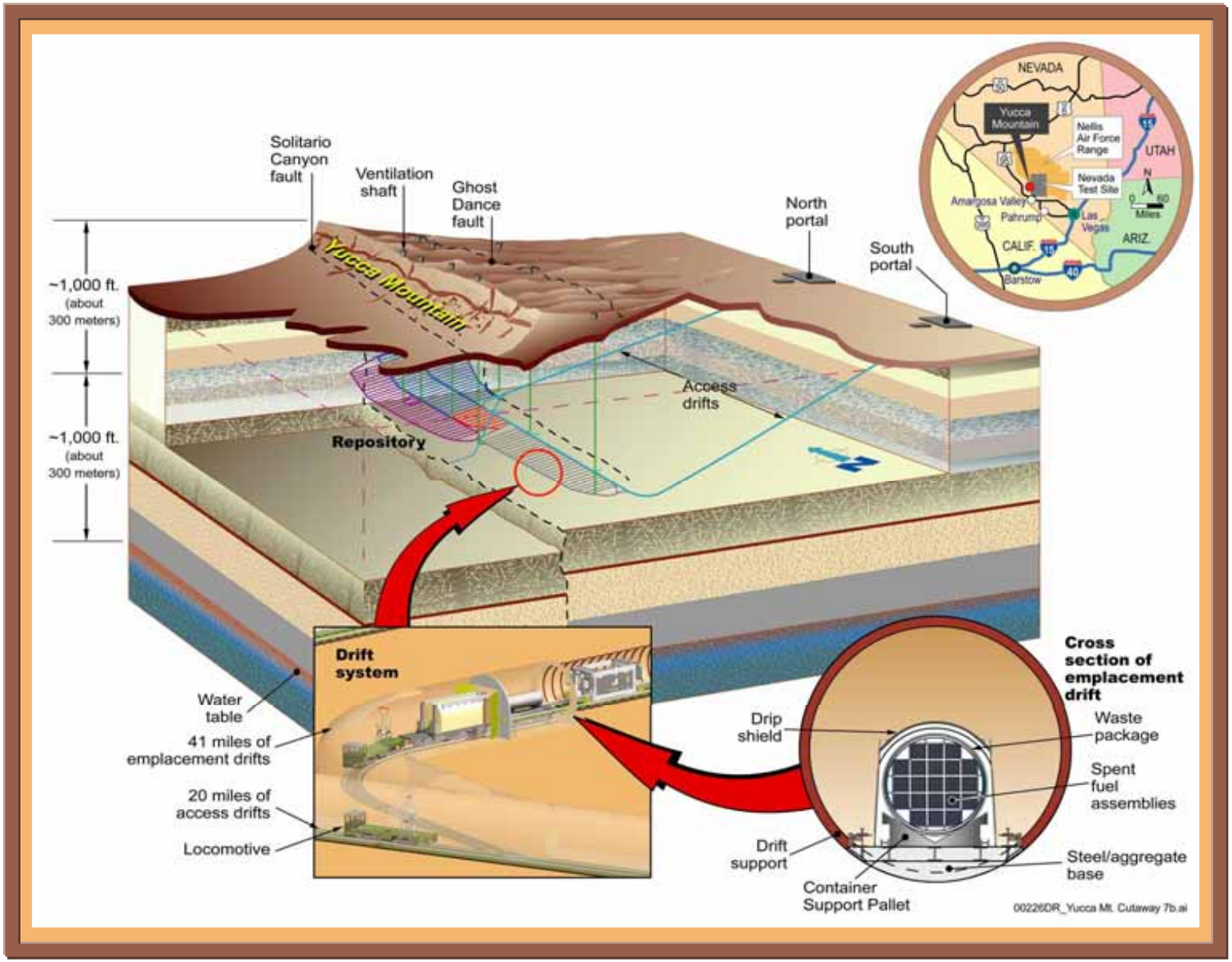


Yucca Mountain Facts and Figures

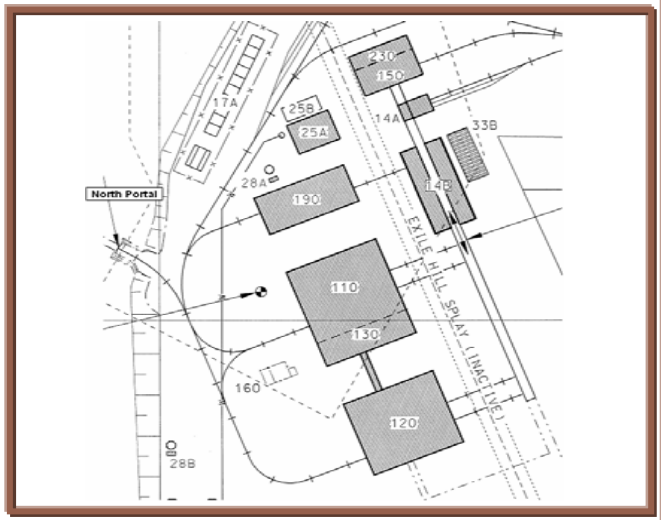
The proposed Yucca Mountain repository . . .

- Will be located approximately 100 miles from Las Vegas in a dry, remote area
- Will be situated among layers of volcanic rock, approximately 11.5 to 14 million years old
- Will be located in the unsaturated zone approximately 1,000 feet above the water table and 1,000 feet below the surface
- Will have approximately 41 miles of emplacement tunnels that will be approximately 25 feet in diameter
- Will involve approximately 1,500 acres, located within an area of federal land withdrawn from public use of 150,000 acres
- Will hold 70,000 metric tons of heavy metal, including commercial spent nuclear fuel and defense high-level radioactive waste
- Will remain within a controlled area that is restricted to public access for the long term

Repository Reference Design Concept

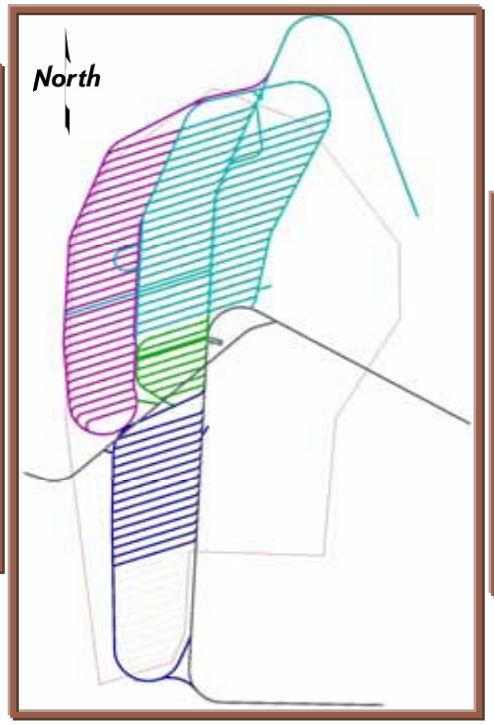


Three Components of Repository Design



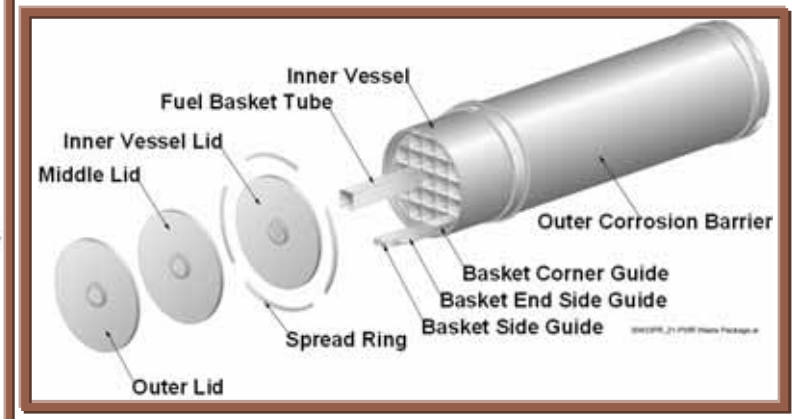
Surface

- Dry handling
- Multiple buildings
- Phased construction
- Dry cask aging



Subsurface

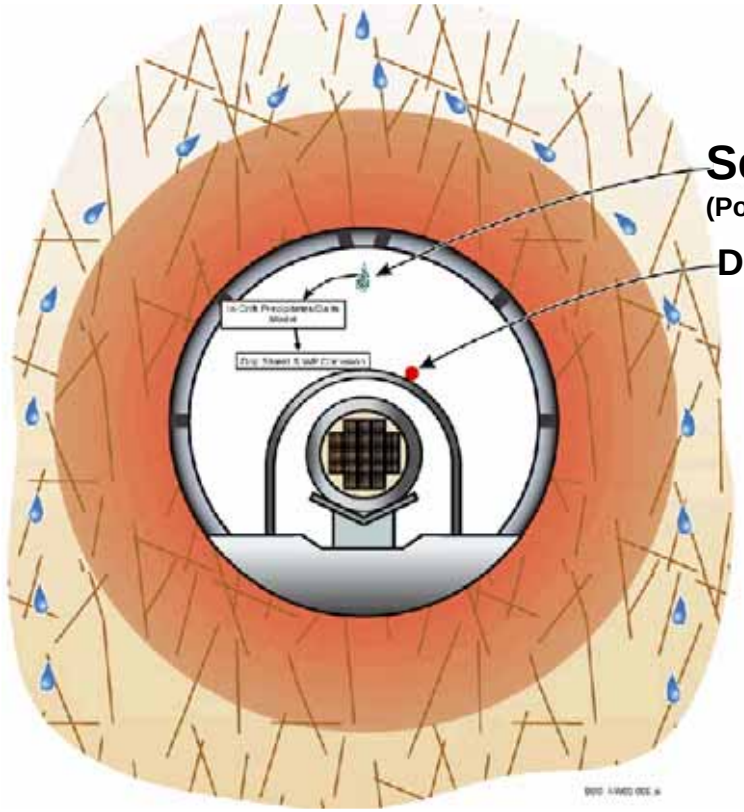
- 266 ft. (81 meters) drift spacing
- Sub-boiling temperature in portion of rock pillars
- One level, 4 panels



Waste Package

- Outer barrier Alloy 22
- Inner barrier stainless steel
- 11.8 kW power limit
- Flat outer lid
- One-piece twist-on trunnion collar
- Spread ring design for inner lid closure

Water Is the Primary Means of Waste Package Degradation and Radionuclide Transport



- **Thermal barrier**
  - Drift wall above boiling temperature
  - No drips onto waste package
- **Capillary barrier**
  - Water retained by unsaturated rock
  - No drips onto waste package
- **Drip shield**
  - No drips onto waste package
- **Highly corrosion-resistant Alloy 22**
  - No significant corrosion in absence of dripping
  - No corrosion in a wide range of waters resulting from dripping

Waste Canisters are Extremely Robust and Corrosion-Resistant

- **Radionuclides are fully isolated if there are no penetrations**
  - **Even penetrated package can limit radionuclide movement**
- **Corrosion rate of passive metals are extremely low**
  - **Realistic rates are less than 1 µm/yr (a millionth of a meter per year) and much less**
  - **Alloy 22 layer is 2-cm thick (a stack of 12 U.S. Quarters)**
- **Major effort has been devoted to analyzing the potential for damage by corrosion**

At realistic passive corrosion rates, it would take 1,600 to 160,000 years to penetrate the thickness of one U.S. Quarter

Repository Licensing Overview

- **We are completing the scientific, technical, and design work necessary to prepare a license application for submittal to the Nuclear Regulatory Commission in December 2004**
- **License application will present the safety analysis for the repository**
  - **Site characteristics**
  - **Repository design features**
  - **Administrative controls**
  - **Preclosure safety analysis**
  - **Postclosure performance assessment**
  - **Performance confirmation program**
- **The goal is to demonstrate that the repository can be constructed, operated, and closed in a manner that protects the public and worker health and safety and preserves the quality of the environment**

Unique Aspects of the Licensing Demonstration

- **Nuclear Regulatory Commission's "triplet" approach to licensing:**
  - **What can go wrong?**
  - **How likely is it to occur?**
  - **What are the consequences?**
- **Must assume inevitable uncertainty and be based on reasonable expectation**
- **Predictive analysis over an extraordinarily long time period**
  - **Operational phase of 50 years for emplacement of waste packages**
  - **Monitoring phase up to 300 years**
  - **Closure phase and regulatory period of 10,000 years, with projected performance to 20,000 years and longer**

We Address Postclosure Performance Through Total System Performance Assessment

- **TSPA: an approach to forecast the behavior of complex systems over long periods of time, through analysis of:**
  - ***Features*** -- identified physical characteristics of the total repository system and how they behave over time
  - ***Events*** -- occurrences that have a specific starting time and are usually of short duration
  - ***Processes*** -- activities that have gradual but continuous interactions with the overall repository system
- **Information derived from experiments and known facts is fed into a series of models, which in turn are used to develop one overarching model**
- **This model is used to forecast the levels of radioactivity to which people near the repository might be exposed**

Other Activities Critical for Beginning Repository Operations in 2010

- **The Department recently announced that it is beginning the process of contractual interactions with nuclear utilities process to plan for waste acceptance in 2010**
- **After many years of deferral due to budget shortfalls, we are accelerating our transportation planning**
  - **We will build on the experience and proven safety record in the U.S. and Europe**
  - **Over the next 6 years, we will develop a transportation system ready to ship SNF and HLW to the repository**

National Transportation Subprojects

CASKS

ROLLING STOCK

SUPPORT FACILITIES

Rail in Nevada

- **We will transport using “mostly rail”**
- **A rail branch line must be constructed to connect the main line in Nevada to the repository**
- **In April 2004, OCRWM issued a Record of Decision on the selection of rail as the primary transport mode and selection of the Caliente Corridor**
- **Also in April, OCRWM issued a Notice of Intent to prepare an Environmental Impact Statement on the rail alignment to the Yucca Mountain repository, and we are implementing the National Environmental Policy Act process**

Big-Picture Issues

- **Importance of implementing a permanent solution for nuclear waste**
  - **Energy security, national security, and environment are at stake**
  - **Nation's electricity consumers have paid for permanent disposal**
- **Longstanding scientific consensus favors geologic disposal**
- **National policy has been consistent for 50 years and has been repeatedly reaffirmed, most recently in 2002**
- **Societal issues remain**
  - **Intergenerational equity: those who have benefited from nuclear power should manage the waste**
  - **Concerns about transportation, despite excellent safety record spanning 30 years (3,000 shipments, 1.6 million miles)**
  - **Confidence in predicting into the far future, and balance between near-term and very long-term risks**

Summary

- Repositories are an essential part of any fuel cycle
- DOE is committed to the safe disposal of U.S. high-level radioactive waste and spent nuclear fuel
- Submittal of the license application to the NRC is planned for 2004
- DOE is proceeding toward waste acceptance in 2010